



U.S. Department of Energy  
Energy Efficiency and Renewable Energy

# **Test Procedures for Distribution Transformers**

## **SNOPR Public Meeting**

# **Uniform Test Method for Measuring Energy Consumption**

**Building Technologies Program  
Office of Energy Efficiency and Renewable Energy  
U.S. Department of Energy**

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## General Characteristics

- **Content: based on IEEE standards C57.12.90, C57.12.91, C57.12.00, C57.12.01 and NEMA standard TP-2**
- **Organization of the document: similar to that of NEMA standard TP-2**
- **In some items more detail is added and language modified because the DOE test procedure is mandatory, not a voluntary guideline**



## Key Elements of the Test Method

- **Test system accuracy requirements**
- **Resistance measurements**
- **Loss measurements**
- **Determination of efficiency**
- **Test equipment calibration and certification**



## Key Element: Test System Accuracy

- Test system accuracy requirements: as in IEEE and NEMA TP-2 standards

Table 2.1 – Test System Accuracy Requirements for Each Measured Quantity

Measured Quantity	Test System Accuracy
Power Losses	$\pm 3.0\%$
Voltage	$\pm 0.5\%$
Current	$\pm 0.5\%$
Resistance	$\pm 0.5\%$
Temperature	$\pm 1.0^{\circ}\text{C}$



## **Key Element: Resistance Measurement**

- **Temperature determination of windings: abbreviated from IEEE standards**
- **DC resistance measurements: more detail added on instrumentation**
- **Conversion of measured resistance: to that at reference temperature**
- **Resistance measurement: required only for one unit of a basic model**



## Key Element: Loss Measurements

- **Test sets: single- and three-phase, with and without instrument transformers**
- **No-load loss measurement (in watts): corrections for instrumentation losses, non-sinusoidal applied voltage, temperature, if outside the  $(20 \pm 10)^{\circ}\text{C}$  range**
- **Load loss measurement (in watts): corrections for instrumentation losses, for phase angle error of instrumentation; adjustment of results to reference temperature**



## Key Element: Determination of Efficiency

- **Adjustment of load loss for reduced output loading**
  - 35% load for dry-type low-voltage units
  - 50% load for liquid-immersed and dry-type medium-voltage units
- **Calculation of total losses**
- **Calculation of energy efficiency**



## **Key Element: Test Equipment Calibration and Certification**

- **As in NEMA TP-2**
- **Detailed description of all steps involved in use, maintenance and calibration, and recordkeeping of test equipment**





## Other Issues?

- **An opportunity for stakeholders to discuss other issues related to the test method for a distribution transformer.**